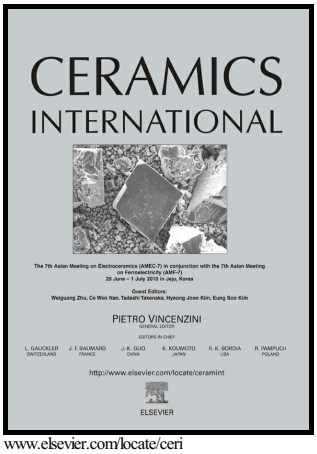

www.elsevier.com/locate/ceri

Microstructure and mechanical properties of porous Si_3N_4/Invar joints brazed with Ag-Cu-Ti+Mo/Cu/Ag-Cu multi-layered composite filler

J.Y. Liu, T.P. Wang, C.F. Liu, J. Zhang

PII: S0272-8842(17)31191-4
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.05.354
Reference: CERI15514

To appear in: *Ceramics International*

Received date: 5 April 2017
Revised date: 14 May 2017
Accepted date: 31 May 2017

Cite this article as: J.Y. Liu, T.P. Wang, C.F. Liu and J. Zhang, Microstructure and mechanical properties of porous Si_3N_4/Invar joints brazed with Ag-Cu-Ti+Mo/Cu/Ag-Cu multi-layered composite filler, *Ceramics International*, http://dx.doi.org/10.1016/j.ceramint.2017.05.354

Microstructure and mechanical properties of porous Si_3N_4/Invar joints brazed with Ag-Cu-Ti+Mo/Cu/Ag-Cu multi-layered composite filler

J. Y. Liu[1], T.P. Wang[2], C.F. Liu[2], J. Zhang[1*]

[1]School of Materials Science and Engineering, Harbin Institute of Technology, Harbin 150001, PR China

[2]State Grid Liaoning Electric Power Research Institute, Shenyang 110006, PR China

[*]Corresponding author:

Tel./fax: +86 451 86414234. hitzhangjie@hit.edu.cn

Abstract

Ag-Cu-Ti/Cu/Ag-Cu multi-layered filler was successfully designed to braze porous Si_3N_4 and Invar alloy. To further reduce the CTE mismatch between the porous Si_3N_4 and brazing filler, Mo particles were introduced into Ag-Cu-Ti. The effects of the Mo addition on the microstructure and mechanical properties of the brazed joints were studied. The results showed that, the addition of Mo particles into Ag-Cu-Ti lowered the CTE mismatch and improved the joint strength to a certain degree. However, an excessive content was harmful. The Mo particles could absorb Ti at high temperature, causing Ti shortage in the reaction with the ceramic. When cooling down, the absorbed Ti was released. The released Ti could react with Cu to generate Cu-Ti phase. So, additional Ti was adopted in the brazing filler as a supplement. When the Ti content was 5wt.%, the reaction layer on the ceramic interface was too thin to transfer enough load. However, when it reached 15wt.%, the Cu interlayer dissolved completely and Fe-Ti and Ni-Ti phases appeared. The maximum joint shear strength (83MPa) was obtained with 10wt.% Ti and 5vol.% Mo, which had exceeded 90% of the porous Si_3N_4 and was 56% higher than the joint brazed without Mo particles.